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UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Devore	Group Art Unit:	3681
Serial No.:	10/721,647	Examiner:	Le, David D.
Filed:	11/25/2003		
Title:	AUTOMATED MECHANICAL TRANSMISSION SYSTEM		

Commissioner for Patents
Mail Stop: Appeal Brief-Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

Appellant submits this Appeal Brief pursuant to the Notice of Appeal filed December 21, 2005

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail, postage prepaid, in an envelope addressed to Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 21st day of March, 2006.

Beth A. Beard

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REAL PARTY IN INTEREST

The real party in interest is **ZF Meritor, LLC**, assignee of the present invention.

RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings related to, may directly affect or may be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 1- 12, and 14-27 are pending, rejected and appealed.

Claims 5, 7-12 and 14-16 were canceled.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

Heavy vehicles have typically been provided with automated transmission systems that change gear ratios without the assistance of a controllable master clutch must address the problem of how to disengage gears while under torque load. The torque load produces excess force at the gear interface and the resulting friction prevents movement within the limits of available control force.. It is desirable, if not mandatory, that a zero torque value be achieved prior to disengagement. The zero torque value at the gear interface changes dynamically with such factors as road conditions, vehicle condition, vehicle configuration, vehicle acceleration/deceleration, overall drive ratio, engine drag during coast among others. [¶[¶2-3]

Current systems measure and/or model the absolute values of the external forces present to identify the zero torque value in terms of absolute torque at the engine and/or other power path points within the vehicle driveline. [¶4]

The present application relates to an automated transmission system that identifies relative torques present within the power path to permit change of gear ratios. [¶1]

A vehicle driveline 20 incorporates an engine 22 driving a clutch mechanism 24. The clutch mechanism 24 is selectively engaged to transmit power from the engine 22 into an automated mechanical transmission 26. The transmission 26 includes an input shaft 28 that is rotationally driven by the engine 22, a main section 30, an auxiliary section 32, and an output shaft 34 that rotatably drives one or more wheels 36 of the vehicle. A pivotable shift lever 42 is provided to effect shifting of the main section 30 of the transmission 26. [¶18-21]

The transmission 26 is of the type provided by shift actuators 50 and 51 (illustrated schematically), such that transmission gear shifts are achieved without direct mechanical shifting by the driver. A shift controller 46 is connected between a driver actuatable switch 48 on the handle 44 and the shift actuators 50 and 51. The shift controller 46 is preferably any kind of electronic controller, such as a microprocessor or a programmable logic circuit which controls the actuators 50 and 51. The controller can be integrated with other system controllers located in the vehicle or its functions integrated with other controllers in a single processor for the whole vehicle. [¶22]

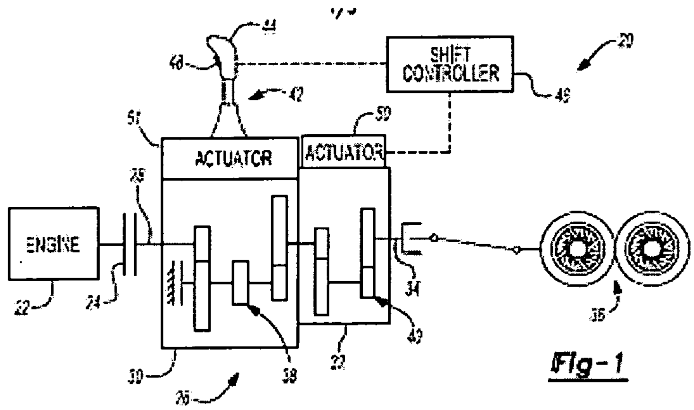
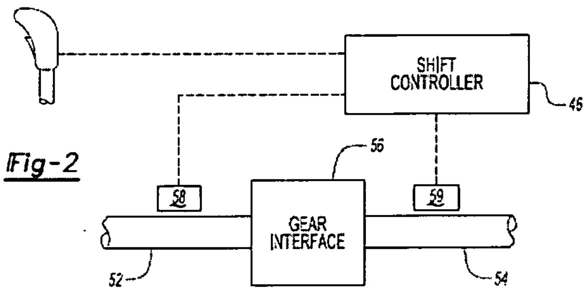


Fig-1

The shift controller 46 relates a relative movement signature to a zero relative torque condition between a first shaft 52 and a second shaft 54 which have a gear interface 56 therebetween. When the torque changes from "pull" to "push" or from "push" to "pull," the gear clearance leads to relative movement of the shafts 52, 54 which indicates a zero torque condition between the shafts 52 and 54. Typically, a useful relative angle signal which is proportional to torque is not identified, because the stiffness is too high and the relative angle for zero torque is different after every gear change. The change of the relative angle within the gear clearance is

useful for the determination of zero torque. That is, zero torque = a relatively large change in relative angle at a relatively small change in engine torque. This is also valid with a clutch between the two sensors, as the relative angle is different after every drive-off or clutch actuation. [¶23]

Fig-2



The controller 46 communicates with a first sensor 58 adjacent the first shaft 52 and a second sensor 60 adjacent the second shaft 54. When the shift controller 46 identifies a relative movement signature indicative of a zero relative torque between the first and second shaft 52, 54 shifting of the gear interface 56 is initiated. [¶24]

The sensors 58, 60 are preferably speed sensors. The signal of a speed sensor in a vehicle power train typically provides the speed and the irregularity of speed which depends on speed level, resonance speed and torque level. In this approach, the torque level is useful information, as the compliance of the driveline results in a speed and speed irregularity signature that changes with load. Real time analysis of the speed and speed irregularity generated by speed sensors during operation reveals changes in the speed irregularity signature as the relative torque approached zero. From that signature, the controller 46 determines zero driveline torque such that a shift may be affected. [¶25]

Another sensor may alternatively or additionally be fastened at a position on the gearbox housing, where the housing vibrations relate to torque. The sensor may measure travel, velocity, acceleration, structure-born sound and/or airborne sound to detect a vibration signature which is then related to torque. The sensor locations include, but are not limited to the driveline, the transmission, or integrated in the transmission's electronic controller. [¶26]

It should be understood that any number of components that have a relative movement capability within the vehicle driveline 20 will benefit from the present invention. Relating the

relative movement to the approach of zero relative torque permits shift changes to be effected at approximately zero relative torque. [¶27]

Generally, when a predetermined signature is identified which relates to the onset of zero relative torque the controller initiates a shift. That is, absolute torque of the components is irrelevant as the present invention relates the relative torques adjacent the gear interface or some other point in power path for that interface to effect a shift. The measurement of zero relative torque using that torque's effect on the system may be, for example, achieved through the measurement of torsional compliance at the clutch, measurement of torsional compliance in the transmission, measurement of the vibration signature from one or more speed sensors, measurement of the vibration signature from one or more acceleration sensors, and/or relative movement of two components. [¶27]

With reference to Figure 3, and as explained with regard to Figure 2, a torsional damper 60 located within a vehicle clutch permits relative movement between an engine shaft 23a and the transmission input shaft 28a when engaged by the clutch 24a. This relative movement results in a relative position change between the engine shaft 23a and the input shaft 28a in response to changing torque. This relative movement may then be utilized to determine when to shift at zero relative torque. [¶28]

With reference to Figure 4, detection utilizes the phase of the oscillations naturally present in each speed signal from the sensors 64, 65 rather than relative speeds of the two sensors. That is, the actual speed is not measured but the oscillations from the sensors 64, 65. [¶29]

With reference to Figure 5, the compliance of the transmission 26c produces relative movement between the transmission input shaft 28c and the transmission output shaft 34c. The relative movement generally changes as a function of the drive train torque such that the relative movement may be utilized by the shift controller 46 to determine when to shift at zero relative torque. [¶30]

With reference to Figure 6, relative movement from an elastomeric coupling 70 may be utilized to determine when to shift at zero relative torque. Such an arrangement may be utilized anywhere within the driveline.

With reference to Figure 7, a relative axial movement of a helical gear shaft 78 may be utilized to determine when to shift at zero relative torque. The axial movement may be detected with a position sensor or a switch which is actuated only when the relative torque approaches zero.

With reference to Figure 8, relative torsional movement (twisting) between a first vehicle component 86 such as, for example only, a gear box output shaft, a flywheel, an input shaft, or the like and the vehicle wheels 88 may be utilized to determine when to shift at zero relative torque.

Summary of Claim 1

Claim 1 recites:

1. A vehicle transmission system comprising:

an automated mechanical transmission shiftable between a first and a second gear ratio;

a first rotational component;

a second rotational component which rotates relative to said first component;

a first sensor adjacent said first rotational component;

a second sensor adjacent said second rotational component;

a controller in communication with said first sensor and said second sensor, said controller operable to determine a relative movement between said first rotational component and said second rotational component indicative of an approximately zero torque condition to initiate a shift between said first and said second gear ratio.

Thus, with reference to Figures 1 and 2, claim 1 recites that the shift controller 46 identifies a <u>relative movement signature</u> indicative of a zero relative torque between two rotational components such that shifting of a gear interface 56 between a first and second gear ratio is initiated. As illustrated in the alternative embodiments of Figures 4-8, various signatures may be utilized.

<u>Summary of Claim13</u>

Claim 13 recites:

13. A method of controlling a vehicle transmission comprising the steps of:

(1) determining a relative movement between a first rotational component and a second rotational component;

(2) relating the relative movement of said step (1) to an approximately zero torque condition; and

(3) shifting the vehicle transmission between a first and a second gear ratio in response to identification of the approximately zero torque condition.

Thus, with reference to Figures 1 and 2, claim 13 recites determining a <u>relative movement</u> between two rotational components; relating the relative movement to an approximately zero torque condition; and shifting a vehicle transmission between a first and second gear ratio is in response thereto.

<u>Summary of Claim 17</u>

Claim 17 recites:

17. A method of controlling a vehicle transmission comprising the steps of:

(1) determining a speed irregularity between a first rotational component and a second rotational component;

(2) relating the speed irregularity of said step (1) to an approximately zero torque condition; and

(3) shifting the vehicle transmission between a first and a second gear ratio in response to identification of the approximately zero torque condition.

Thus, with reference to Figures 1 and 2, claim 17 recites determining a <u>speed irregularity</u> between a first rotational component and a second rotational component, relative the speed irregularity to an approximate zero torque condition; and shifting a vehicle transmission between a first and second gear ratio in response thereto.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

I. Claims 1-4, 6, 13, and 17 were rejected under 35 USC §102(b) as being anticipated by *Huber* (6,151,978).

ARGUMENT

I. §102 Rejection

Independent claim 1 is patentable independently of independent claims 13 and 17

Claims 1-4, 6, 13, and 17 were rejected under 35 USC §102(b) as being anticipated by *Huber* (6,151,978). Applicant respectfully traverses this rejection. Initially, it should be understood that *Huber* is assigned to Appellant and Appellant is thus intimately familiar with *Huber.*

The Examiner refers to column 3, lines 21-26 as reproduced below to argue "clearly *Huber '978* implicitly determines relative movement between the first rotational component (being the input shaft 16) and the second rotational component (being the transmission input shaft 20) via the speed sensor (40) and the speed sensor (42) respectively, indicative of an approximate zero torque condition." [9-21-2005 Office Action, page 5]

> position. The preferred embodiment of this invention determines the status of the clutch by utilizing information that is already available and necessary for other portions of the transmission control. The transmission control unit **32** and the engine control unit **34** utilize information regarding the rotational speeds of the engine output shaft **16** and the transmission input shaft **20**. Sensors are schematically illustrated at **40** and **42** for providing the speed information regarding those shafts.

Initially, what the Examiner argues is "clearly" shown simply cannot be so as the Examiner is forced to rely only upon what is ***implicitly*** shown by *Huber* rather that what is explicitly shown. Such implicit recitation is unacceptable under a 35 USC § 102 rejection.

Furthermore as admitted by the Examiner, each of the sensors (40, 42) provides "speed information regarding those shafts." [Col. 3, lines 25-26.] The Examiner is therefore essentially re-iterating Applicant's point that the Huber reference is similar to the prior art discussed in the background section of Appellant's application. In other words, *Huber* is **measuring the exact speed of the shafts** so that the engine control can cause the engine to be driven in a known manner to a speed that results in the zero torque condition. *Huber* specifically recites:

> shifting procedure. The controller **32** communicates with the engine control **34** to cause the engine **12** to be driven in a known manner to a speed that results in zero torque between the engine output shaft **16** and the transmission input shaft **20**. Once zero torque conditions are achieved, the shift actuator **36** causes the transmission **14** to be moved out of the currently engaged gear into neutral. The controller **32**
>
> **3**
>
> then communicates with the engine control **34** to cause the engine **12** to be driven to a synchronization speed in a known manner so that the selected gear can be engaged. Under synchronous conditions, the shift actuator **36** is commanded to move the transmission **14** into the selected gear. Once the selected gear is engaged, engine control is returned to the driver of the vehicle to continue driving.

[Col. 2:61 – Col. 3:7, emphasis added.]

Huber therefore fails to disclose or suggest determining <u>a relative movement signature</u> as recited in claim 1.

Although effective, *Huber* discloses measuring shaft speed then specifically driving the engine 12 in response to the measured shaft speeds to reach a zero torque condition. In other words, Huber could be considered "proactive" with regard to forcing the zero torque condition while the present application could be considered "reactive" in that it determines when an approximately zero torque condition occurs by determining a signature or other indicator - not by directly measuring shaft speed.

<u>Independent claim 13 is patentable independently of independent claims 1 and 17</u>

Independent claim 13 is a method claim which generally follows claim 1 by reciting: determining a <u>relative movement</u> between two rotational components; relating the relative movement to an approximately zero torque condition; and shifting a vehicle transmission between a first and second gear ratio is in response thereto. As discussed above with regard to claim 1, *Huber* is **measuring the exact speed of the shafts** so that the engine control can cause the engine to be driven in a known manner to a speed that results in the zero torque condition.

Huber is not concerned with relative movement of the components – only their rotational velocity. It should be noted that the shaft of *Huber* must necessarily rotate in the same direction across the clutch thus, although there may be difference in rotational velocity, *Huber* is only concerned with the rotational velocity of each – not relative movement.

Huber therefore fails to disclose or suggest determining <u>relative movement</u> as recited in claim 13.

<u>Independent claim 17 is patentable independently of independent claims 1 and 13</u>

Independent claim 17 is a method claim which generally follows claim 1 by reciting: determining a <u>speed irregularity</u> between a first rotational component and a second rotational component, relative the speed irregularity to an approximate zero torque condition; and shifting a vehicle transmission between a first and second gear ratio in response thereto. Again, *Huber* only **measures the exact speed of the shafts,** i.e., their rotational velocity -- *Huber* is not concerned with speed irregularities.

Huber therefore fails to disclose or suggest determining a <u>speed irregularity</u> as recited in claim 17.

Claim 3 is patentable independent of its independent claim

Claim 3 depends from claim 1 and recites <u>wherein said controller identifies a speed irregularity signature</u>. Such language recites the "reactive" nature of the present invention. It should be noted that the limitation is speed irregularity ***<u>signature</u>*** not just a speed signal or speed measurement as disclosed by *Huber*. Claim 3 is properly allowable.

Claim 19 is patentable independent of its independent claim

Claim 19 depends from claim 1 and recites wherein said movement includes a predetermined signature. Again, such language recites the "reactive" nature of the present invention and specifically recites that Appellant claims a signature indicative of a zero relative torque between two rotational components. *Huber,* again, is specifically measuring shaft rotational speeds, not attempting to determine a predetermined signature. Claim 19 is properly allowable.

Claims 4 and 20 are each patentable independently of their independent claims

Claims 4 and 20 recites determining a predetermined **noise signature** indicative of the approximately zero torque condition. *Huber* fails to disclose or suggest determining any signature whatsoever, and certainly does not disclose or suggest determining a predetermined noise signature as recited in claims 4 and 20. Claims 4 and 20 are properly allowable.

CONCLUSION

For the above reasons, the rejections by the Examiner should be reversed. A check in the amount of $620 is enclosed for the filing fee and a one-month extension of time. If any additional fees or extensions are due, please charge Deposit Account No. 50-1482.

Respectfully Submitted,
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CLAIMS APPENDIX

1. A vehicle transmission system comprising:

an automated mechanical transmission shiftable between a first and a second gear ratio;

a first rotational component;

a second rotational component which rotates relative to said first component;

a first sensor adjacent said first rotational component;

a second sensor adjacent said second rotational component;

a controller in communication with said first sensor and said second sensor, said controller operable to determine a relative movement between said first rotational component and said second rotational component indicative of an approximately zero torque condition to initiate a shift between said first and said second gear ratio.

2. The vehicle transmission system as recited in claim 1, wherein said first and second sensor are speed sensors.

3. The vehicle transmission system as recited in claim 1, wherein said controller identifies a speed irregularity signature generated by said first and second sensor.

4. The vehicle transmission system as recited in claim 3, wherein said controller identifies a first noise signature component indicative of said approximately zero torque condition.

6. The vehicle transmission system as recited in claim 1, wherein said first component comprises a shaft.

13. A method of controlling a vehicle transmission comprising the steps of:

(1) determining a relative movement between a first rotational component and a second rotational component;

(2) relating the relative movement of said step (1) to an approximately zero torque condition; and

(3) shifting the vehicle transmission between a first and a second gear ratio in response to identification of the approximately zero torque condition.

17. A method of controlling a vehicle transmission comprising the steps of:

(1) determining a speed irregularity between a first rotational component and a second rotational component;

(2) relating the speed irregularity of said step (1) to an approximately zero torque condition; and

(3) shifting the vehicle transmission between a first and a second gear ratio in response to identification of the approximately zero torque condition.

18. The vehicle transmission system as recited in claim 1, wherein said first rotational component and said second rotational component are connected to a gear interface such that said second rotational interface component rotates relative to said first rotational component through said gear interface.

19. The vehicle transmission system as recited in claim 1, wherein said relative movement includes a predetermined signature between said first rotational component and said second rotational component.

20. A method as recited in claim 13 wherein said step (1) comprises determining a predetermined noise signature indicative of the approximately zero torque condition.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

There are no related proceedings.